A Gridded CrIS/ATMS Visualization for Operational Forecasting

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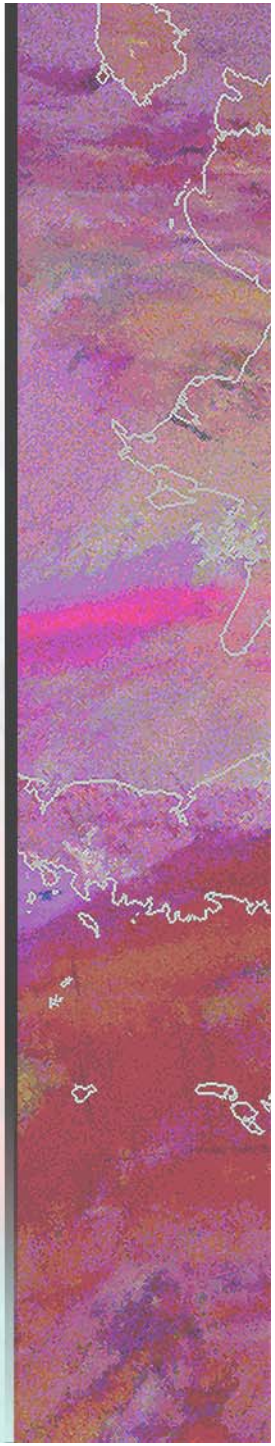
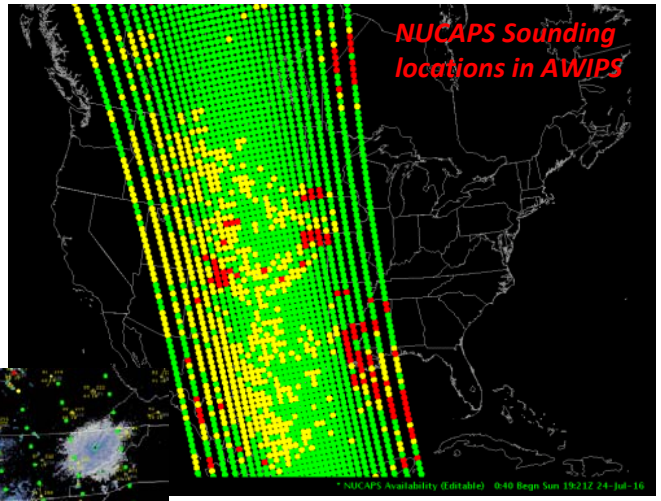
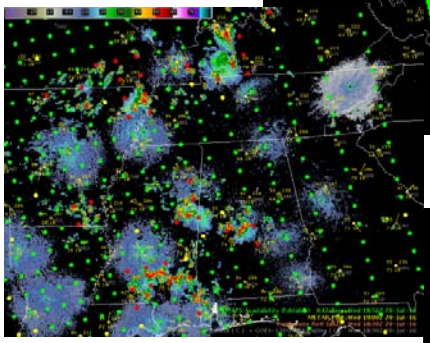


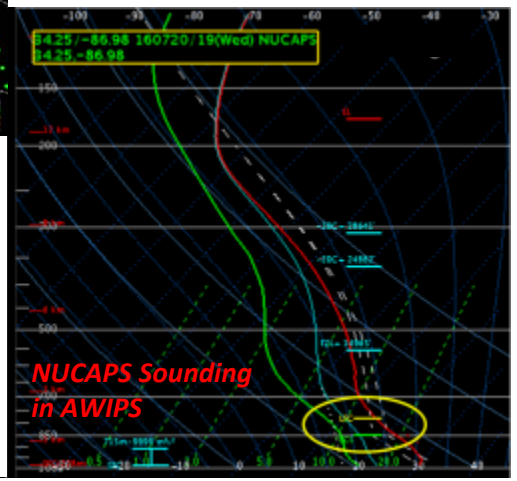
Current Operational NUCAPS Visualization

- NUCAPS is the NOAA Operational Retrieval algorithm for CrIS/ATMS and IASI/AMSU T and q profiles
- Capabilities for displaying individual Skew-T plots are available in the latest versions of AWIPS II with quality control flags
- Skew-Ts are valuable for some forecast challenges, but ***visualizing the data in plan view or cross section may be more useful for others***
- Multi-organization group—started through NUCAPS Initiative—has been funded by JPSS PG/RR to demonstrate these capabilities with NWS forecasters





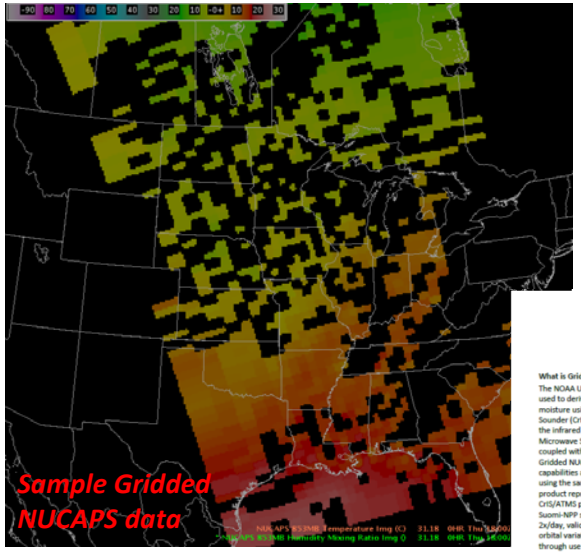
NUCAPS Sounding locations overlaying radar in AWIPS

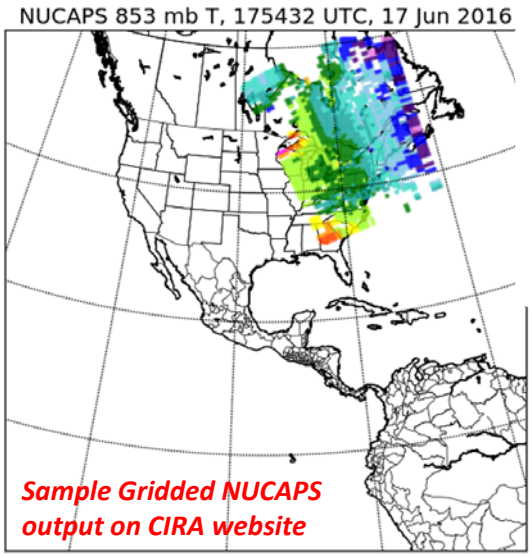


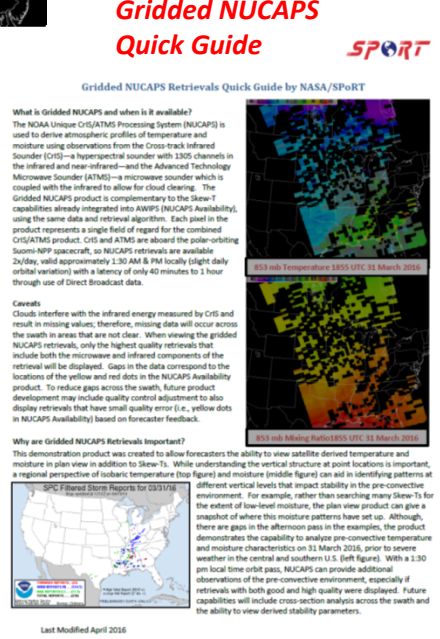
Images by Kris White (NWS HUN/NASA SPoRT)

Gridded NUCAPS for Demonstration

- CIMSS has modified its polar2grid software package to include readers for NUCAPS
- SPoRT obtains Direct Broadcast data, runs polar2grid, and converts output to gridded binary (GRIB2) format for ingest into AWIPS II
- GRIB2 files are pushed to NWS partners in real-time
- CIRA obtains the GRIB2 output and creates graphics for its website that can be linked by forecasters in public statements
- Team has developed training and quick guides that leverage foundational NUCAPS training

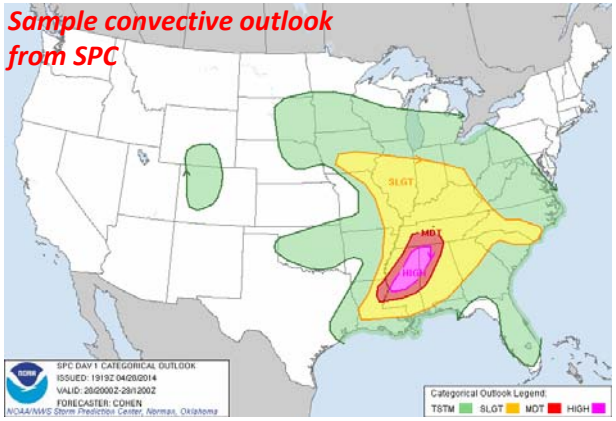


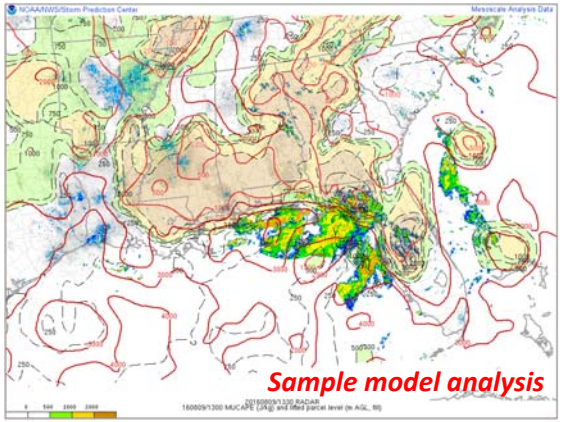


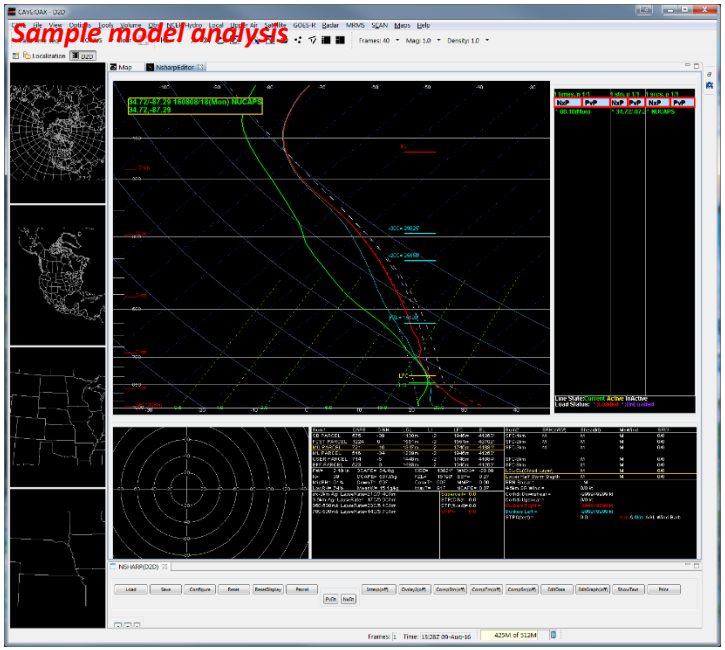


Forecast Challenge: Diagnosing Convective Environment

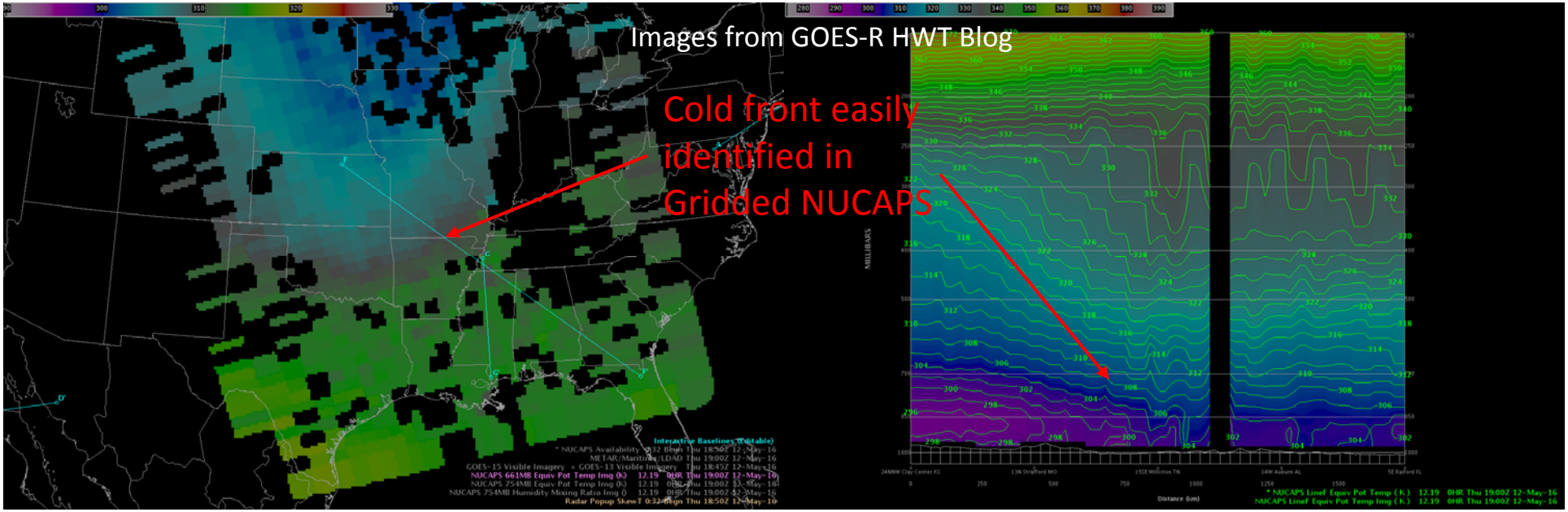
- The vertical distribution of temperature and moisture in the lower atmosphere determines convective potential
- Forecasters use a combination of in situ observations, satellite data, and models to determine the location of boundaries and areas of instability
- Ability to view plan view and cross sections of NUCAPS data in a beta version were demonstrated at the 2016 Hazardous Weather Testbed Experimental Warning Program
- Next slides detail feedback from forecasters at HWT on utility of Gridded NUCAPS products





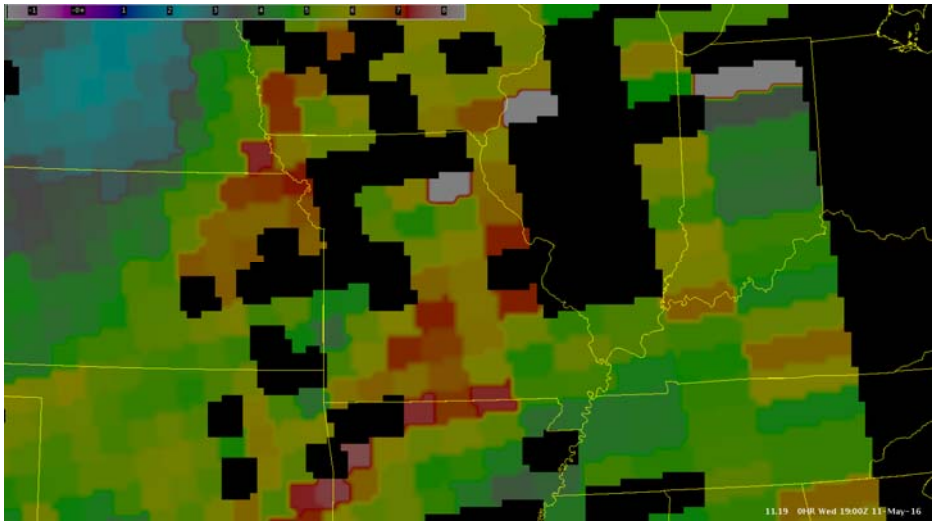


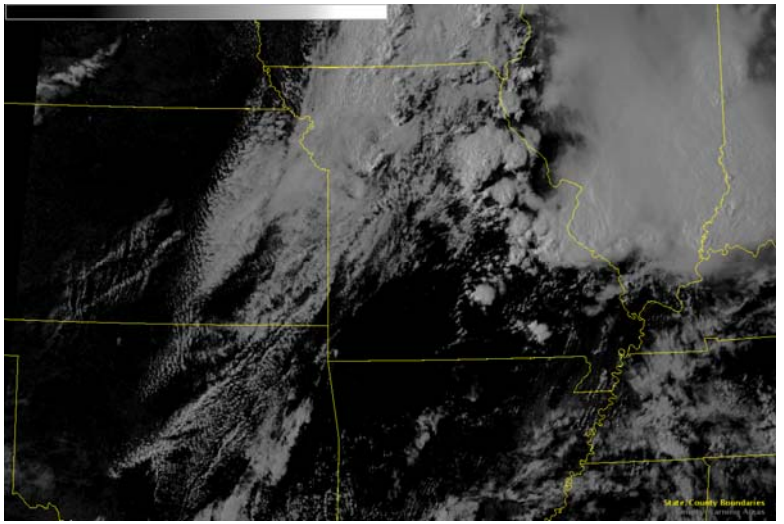
Gridded NUCAPS Convection Application



“We recently gained the ability to create cross sections through the NUCAPS swaths. This will be helpful for diagnosing phenomena such as boundaries and convective instability. The first image below is a plan view display of theta-e at 660 mb across the region. Obvious is the much cooler, drier air behind the cold front (low theta-e) with moist, warmer air ahead of it to the east (high theta-e). Also plotted is a line, denoting the location for which the cross-section (image below) was taken, through the cold front. The cross-section depicts theta-e vertically through the atmosphere. This provides another perspective on the cold front, which is obvious in the image.”

Gridded NUCAPS Convection Application





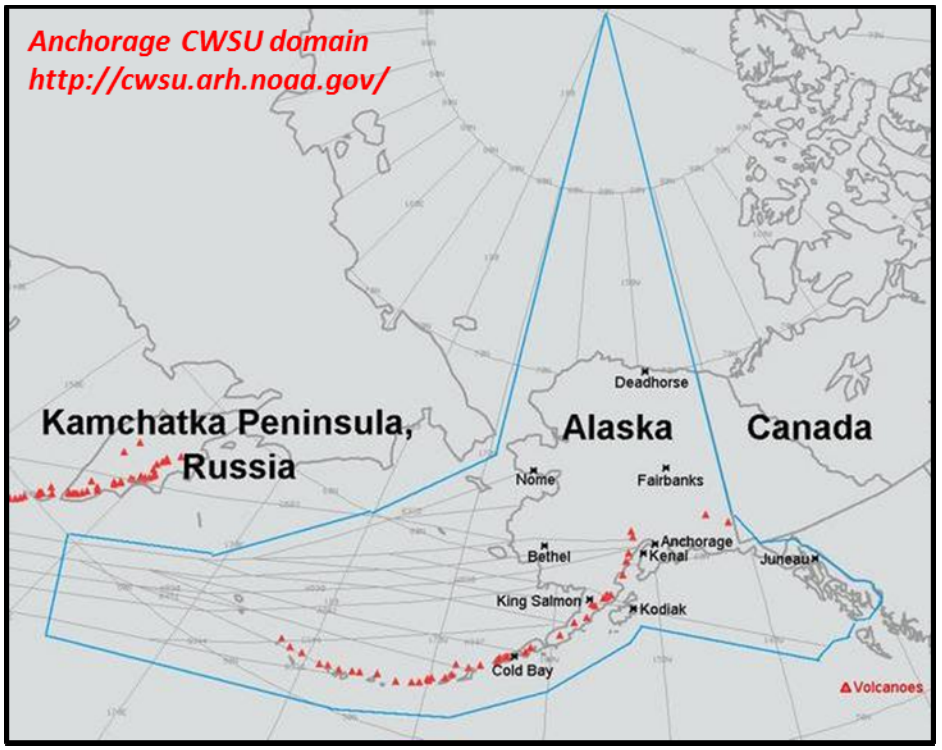
Images from GOES-R HWT Blog

“We took a look at a NUCAPS plan view image of mid-level moisture (754 mb mixing ratio) from 19Z. Image shown below. Areas of higher moisture were apparent over south-central Missouri in our SGF CWA, and over the St. Louis metro area.

Several hours later, we noted that convective activity was focused in these general areas. The few cells that developed over our CWA were over the south-central part of the state. Much more significant convection triggered over the St. Louis area. –JP”

Forecast Challenge: Cold Air Aloft

- Cold Air Aloft (≤ -65°C) can lead to freezing airliner fuel and regularly occur at flight levels in the arctic
- Center Weather Service Units (CWSU) provide Meteorological Impact Statements (MIS) to Air Traffic Controllers to direct flights around the 3D air features
- In data sparse Alaska, forecasters have relied on analysis and model fields and limited radiosonde observations to guess the 3D extent of the Cold Air Aloft
- Use of satellite observations provides an opportunity for forecasters to observe the 3D extent of the Cold Air Aloft in real-time where conventional observations are lacking

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FAAK20 KZAN 121458
ZAN MIS 01 VALID 121500-130300
...FOR ATC PLANNING PURPOSES ONLY...
COLD AIR ALOFT
FROM 185NE SCC-65NE ORT-55SW ENN-110NW BRW-185NE SCC
TEMPS -65C OR LESS FM FL350-400. AREA MOVG NE 40 KTS.
CMW NOV 14
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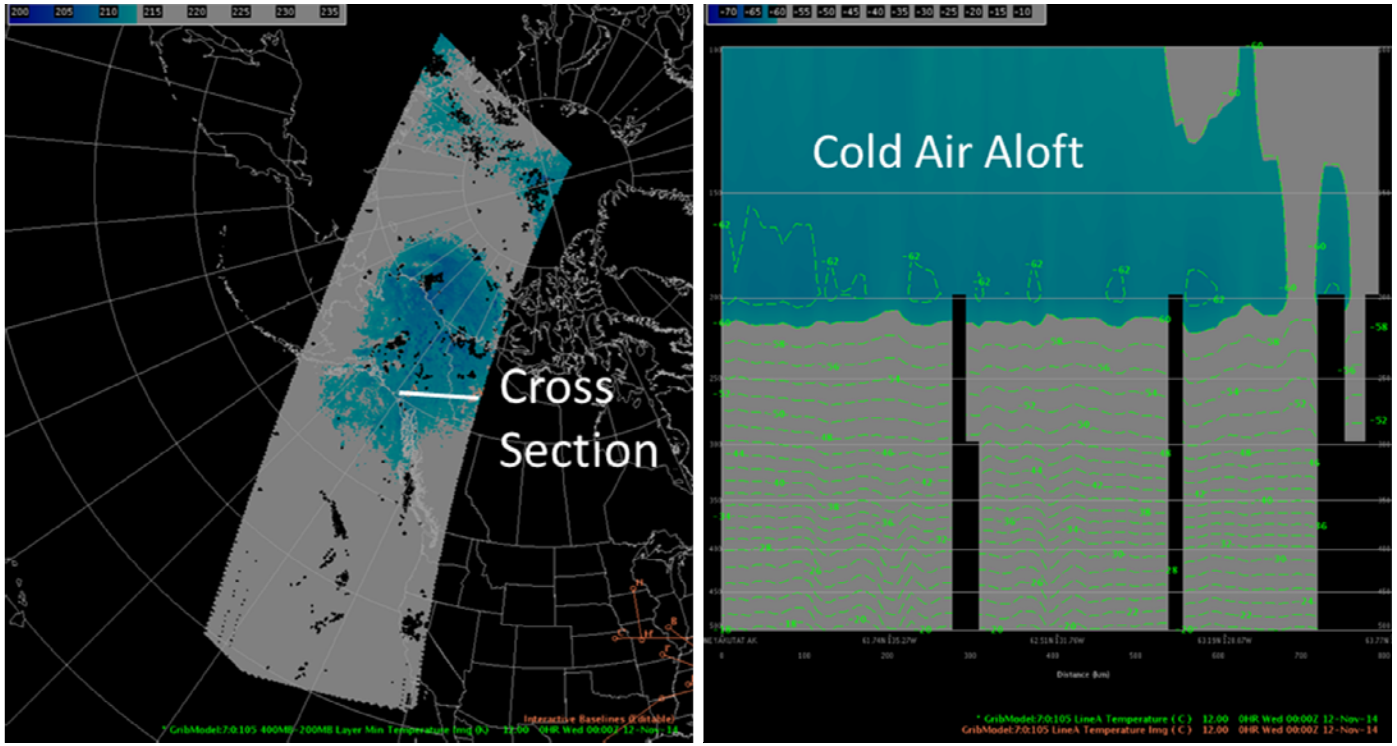
Lat/Lon Extent of Cold Air from soundings, aircraft reports, model

Vertical Extent of Cold Air from soundings/aircraft reports/model

Motion determined from model data

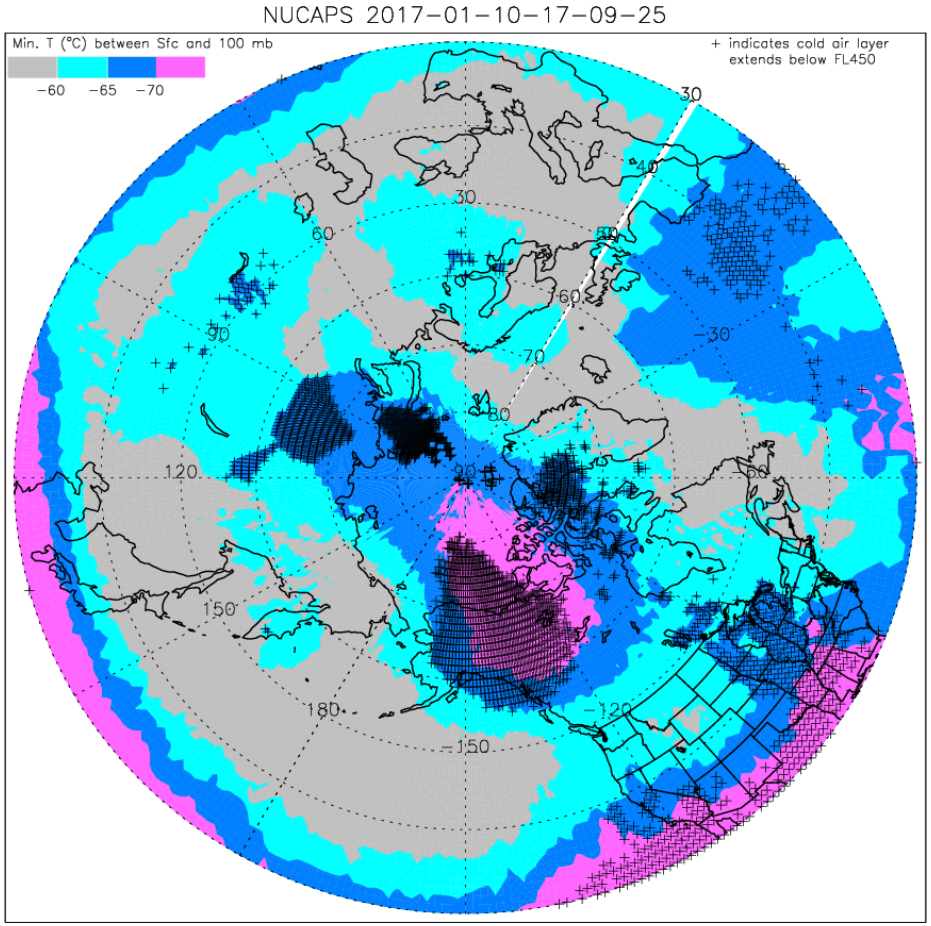
AWIPS Visualization of Cold Air Aloft

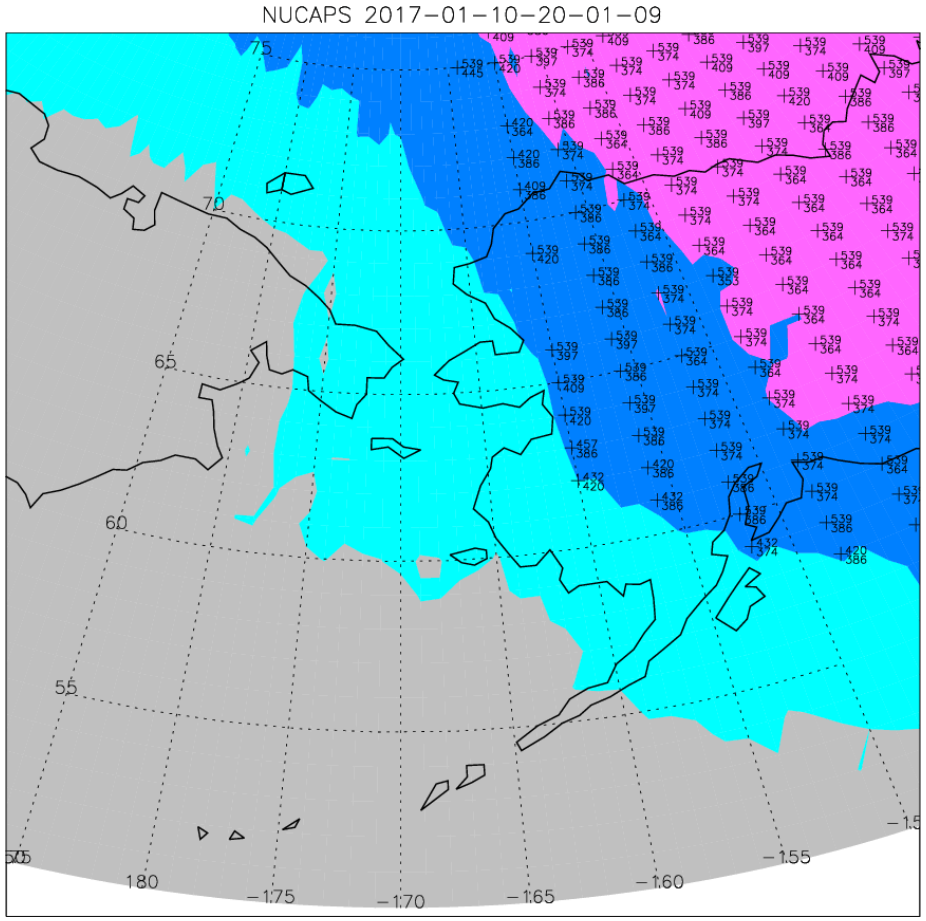
- Developed specific visualization color curve and AWIPS procedures to outline the coldest air and allow forecasters to easily toggle between pressure levels
- Light blue shading for temperatures anywhere below 100 hPa in the column that are < -60°C
  - Darker blue shading for temperatures anywhere below 100 hPa in the column that are < -65°C
- Forecasters at Alaska WFOs and CWSU now have access to this visualization in their operational AWIPS systems for ongoing demonstration



AWIPS Visualization on Web

- As part of this project, CIRA has integrated NUCAPS soundings as part of their Cold Air Aloft web portal where images of the total column data are shown
- 10 January 2017 case shown here is a CAA event where Alaska CWSU where forecasters determined very large impact of the NUCAPS data for giving additional confidence in model output





Summary and Next Steps

- A collaborative project between CIRA, CIMSS, GINA, NOAA/NESDIS, STC Inc., and SPoRT has developed a unique visualization for the CrIS/ATMS NUCAPS soundings for forecast challenges, including convective potential and cold air aloft
- Product demonstrations occurred in Spring 2016 at the HWT and ongoing at the AK CWSU have yielded positive forecaster feedback and have also provided ideas for making incremental changes to the product to make it more useful in operations

- Plan to participate in next HWT Spring Experiment with more robust training on using the gridded products
- Working with the AWIPS Development community to develop gridding capabilities internal to AWIPS source code that will use NUCAPS files already coming over the Satellite Broadcast Network (SBN) directly into NWS offices to reduce data flow and provide full transition of capability into operations

Acknowledgements

This project is funded by the NOAA Joint Polar Satellite System Proving Ground/Risk Reduction Program, directed by Dr. Mitch Goldberg. We would also like to thank the forecasters from the Alaska Center Weather Service Unit (CWSU), Alaska Aviation Weather Unit (AAWU), and participants of the 2016 HWT for their time and effort in providing feedback on the Gridded NUCAPS products.

Any questions?

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